REMARKS

The following remarks make of record what was discussed at an interview held on December 4, 2003, between the Examiner and Applicant's Attorney of record, Geoffrey Myers. These remarks are believed to place this case in prima facie condition for allowance as per the interview.

As discussed at the interview, the certified copy of the foreign document is objected to because the certified copy is said not to be a complete document. However, as discussed at the interview, the actual certified copy only includes a one-page disclosure and a cover certification page. A copy of this Certified Copy is attached hereto and its inclusion in the file is requested.

IN THE DRAWINGS

Applicant respectfully requests that the objection to the drawings be held in abeyance until allowable subject matter is found, per the Rules of Practice.

IN THE CLAIMS:

Claims 1-9 are currently pending in this application.

Claim 1 has been rejected under 35 U.S.C. § 102 (b) as being anticipated by Kojima et al. The examiner has pointed out that Kojima et al. discloses an optical waveplate comprising polyethylene naphthalate (col. 3 line 33-42).

The applicant has carefully considered the examiner's comments and requests reconsideration of this rejection.

Claim 1 of the instant application defines:

An optical waveplate comprising polyethylene naphthalate.

An optical waveplate is a device that will induce retardation (usually a half or quarter wave) to orthogonal polarization components of light passing through it.

The following definition is taken from P.D. Hale and G.W. Day in "Stability of birefringent linear retarders (waveplates)" , Applied Optics, vol. 27, no. 24, 15 Dec. 1988, p.5146.

The first and third sentences in the article read:

"Linear retarders, sometimes called waveplates, are optical components that introduce a phase shift between two orthogonal, linearly polarized components of light transmitted thorough them."

"A linear retarder that introduces a phase shift of pi radians, a halfwaveplate, is often used as a polarization rotator."

The examiner specifically points out that Kojima discloses an optical waveplate comprising polyethylene naphthalate in col 3 lines 33-42.

Col 3 lines 33-42 read as follows:

"A <u>substrate</u> which will serve as the first sheet is procured. This substrate may be a suitably selected material which has transparency, heat resistance, solvent resistance and <u>dimensional stability</u>, and is strong because the resulting screen is used repeatedly. <u>Examples of the substrate are about 50 to 500 μm, preferably 75 to 200 μm thick sheets or plates of resins</u> such as polyethylene terephthalate, triacetyl cellulose, polyethylene naphthalate, polyvinyl chloride, polypropylene, acrylics, polyimide, diacetate, triacetate, and polystyrene" (Underlining has been added for emphasis).

Nowhere does Kojima et al. disclose an <u>optical waveplate.</u>

Nowhere does Kojima teach an optical waveplate or suggest its functionality as described in the instant specification, or as described by P.D. Hale and G.W. Day in the passages above.

Kojima teaches a <u>dimensionally stable substrate</u> said to be a <u>sheet or plate of resin</u> having a thickness between 50 and 500 μm of any one of polyethylene terephthalate, triacetyl cellulose, polyethylene naphthalate, polyvinyl chloride, polypropylene, acrylics, polyimide, diacetate, triacetate, and polystyrene; the applicant claims "An optical waveplate comprising polyethylene naphthalate (PEN)".

Kojima instructs the reader of his patent to use a range of thickness of the "sheet oThplate" that is outside of a working range useful for an optical waveplate or linear retarder for use in optical waveguide or telecommunications related inventions. It should also be noted that unstretched PEN does not exhibit birefringence. If one were to stretch PEN in order to achieve a highly dimensionally stable substrate as Kojima teaches, it would likely be stretched biaxially with substantially equal stretching to achieve equally enhanced mechanical properties. This would not lead to an optical waveplate.

What is not at all obvious, or straightforward, is that one can use mechanically stable, and therefore pre-stretched commercially available low cost PEN foil, and further treat it to obtain waveplate requirements for applications in waveguide components for telecommunications applications.

Kojima's device is a reflecting screen for video projector applications. Visible light with a broad spectrum ranging from violet ~400 nm up to red ~800 nm. But the PEN sheet in his device cannot function as a waveplate for all wavelengths in the visible range of wavelengths, and the PEN in Kojima's device would not serve as a waveplate for wavelengths in the telecommunications window, to which the instant invention is directed. Note: a quarter waveplate for 800 nm will be a half waveplate for 400 nm.

It is clear from Kojima's disclosure that a "sheet or plate" as defined in col.3 lines 33-42 is to be a dimensionally stable sheet serving as a transparent substrate. Kojima has selected materials (listed above from col.3 lines 33-42 that serve as transparent, dimensionally stable sheet or plate substrates. Notwithstanding, several of the materials that are listed by Kojima, even when highly stretched, which is not suggested by Kojima et al., exhibit very <u>low</u> birefringence and would make very poor optical waveplates or linear retarders. For example in highly stretched cellulose triacetate, one of the materials listed by Kojima, the brifringence is only –0.005 as disclosed in "Properties of polymers", by D.W. van Krevelen, Elsevier 1972, page 319. The

inventor of this invention has made the novel discovery that axially stretched PEN can have a birefringence of up to 0.3 and is very useful as an optical waveplate. The consequence of this is that a half waveplate of cellulose triacetate would have to be two orders of magnitude thicker than a PEN waveplate resulting in a waveplate of millimeter thickness which is much too thick to use in waveguide applications where a maximum allowable thickness is approximately 25 μm.

The thickness range of PEN suggested by Kojima for use as a substrate, is simply not practicable for optical waveplates and would not yield a quarter or half wave retarder for wavelength of light associated with telecommunications or optical waveguides.

Applicant in his specification teaches a method for obtaining an optical waveplate from a film of PEN.

"To obtain a waveplate, the PEN material is extruded into a film. The extrusion process is followed by two-dimensional (biaxial) stretching, to bring the thickness to the desired value and to enhance the in-plane mechanical properties. To bring the in-plane birefringence to the desired level, an additional one-dimensional (uniaxial) stretching (post stretching) is applied." page 4, paragraph [14].

Kojima does not teach or suggest any such process and does not even mention that his substrate materials exhibit any birefringence or can be made to have a predetermined birefringence.

Claim 1 has been rejected under 35 U.S.C. § 103 (a) as being unpatentable over Ando et al ('259, cited in the IDS) in view of Kojima et al, ('392).

Ando is said to disclose an optical waveplate having essentially all of the limitations in applicant's claims without specifically disclosing that the waveplate comprises polyethylene naphthalate (PEN). The examiner has stated that Kojima et al. discloses the wave plate comprises polyethylene napthalate, and therefore it would have been obvious to one of ordinary skill in the art, at the time of the invention to modify Ando et al so that the waveplate comprises polyethylene naphthalate in view of Kojima et al to have better propagation signals.

One significant advantage of the PEN in accordance with the teachings of this invention, is that the processing of PEN by more, or less, continuous extrusion, (i.e. meters wide, and up to 100's of meters long) process followed by stretching in line with the extrusion yields bulk quantities of high performance material. In contrast, the process of Ando et al, is a wafer scale process; spincoating of a fluid monomer onto a Si wafer, peeling the film off the wafer and followed by alignment via a thermal contraction process.

The discovery of the usefulness of PEN as an optical waveplate, versus PET or the other materials listed by Kojima et al. as a dimensionally stable substrate, is not insignificant. PEN is the only material we know of that offers inexpensive processing that can be easily controlled, and that provides extremely high birefringence even when the material is very thin, a requirement for telecom waveguide applications. Kojima never even alludes to the material being birefringent, and Kojima's material, if truly dimensionally stable, likely exhibits little or no birefringence.

It should be noted that the term "waveplate" or "wave plate" is not mentioned once in the Kojima et al. patent. It should also be noted that Kojima never mentions, retardance, linear retardance, or birefringence in his application. He merely suggests using any of 10 different materials to provide a dimensionally stable substrate in the form of a sheet or plate. The word "plate" and "sheet" are used interchangeably.

The definition of a "plate" found in Merriam Webster's Online Dictionary is:

a smooth flat thin piece of material b (1) **:** forged, rolled, or cast metal in sheets usually thicker than 1/4 inch (6 millimeters) (2) **:** a very thin layer of metal deposited on a surface of base metal by plating **c :** one of the broad metal pieces used in armor; *also* **:** armor of such plates **d** (1) **:** a lamina or plaque (as of bone or horn) that forms part of an animal body; *especially* **: SCUTE** (2) **:** the thin under portion of the forequarter of beef; *especially* **:** the fatty back part -- see BEEF illustration **e : HOME PLATE f :** any of the large movable segments into which the earth's lithosphere is divided according to the theory of plate tectonics.

The definition of a "sheet" found in the same dictionary is:

1 a : a broad piece of cloth; *especially* **: BEDSHEET b : SAIL** 1a(1)

2 a (1) **:** a usually rectangular piece of paper; *especially* **:** one manufactured for printing (2) **:** a

rectangular piece of heavy paper with a plant specimen mounted on it <an herbarium of 100,000 *sheets*> **b :** a printed signature for a book especially before it has been folded, cut, or bound -- usually used in plural **c :** a newspaper, periodical, or occasional publication <a gossip *sheet*> **d :** the unseparated postage stamps printed by one impression of a plate on a single piece of paper; *also* : a pane of stamps

3 : a broad stretch or surface of something <a *sheet* of ice>

4 : a suspended or moving expanse (as of fire or rain)

5 a : a portion of something that is thin in comparison to its length and breadth **b :** a flat baking pan of tinned metal <a cookie *sheet*>

6 : a surface or part of a surface in which it is possible to pass from any one point of it to any other without leaving the surface <a hyperboloid of two *sheets*>

- **sheet-like** *adjective*

Neither of these definitions relate in any manner to a “waveplate” or “wave plate” which is defined to be a linear retarder.

It is clear to a reader of Kojima et al. that the term plate is synonymous with a sheet and not with a linear retarder.

In view of this, it would not be obvious to one of ordinary skill in the art to use Kojima’s sheet of polyethylene naphthalate as a wave plate any more than it would be to use cellulose triacetate which would not practicably function as a linear retarder or waveplate for use with optical waveguides in telecommunications applications.

In fact a reader of Kojima et al. would simply have no suggestion or reason to think that any or even one specific material of the list of materials for a dimensionally stable substrate might function as a wave plate.

The examiner stated that it would be obvious to modify Ando et al. so that the waveplate comprises polyethylene naphthalate in view of Kojima et al to have better propagation of signals.

It is unclear to the applicant why someone who was interested in a relatively inexpensive, useful highly birefringent material having a desired thickness within an acceptable range of thickness of less than our about 25μm that has to be stretched in a controlled manner to form a

half or quarter waveplate, that is compatible for use with optical waveguides, would look at a reference which lists 10 possible materials for use as a transparent substrate, which does not mention birefringence, which does not mention stretching, which does not disclose a waveplate and which does not mention waveguides, and wherein most of the materials in the same list would not practicably function as waveplates for use in waveguide applications.

In summary, there is simply no motivation or suggestion to combine Ando with Kojima. Ando is addressed to a single material, PET as a waveplate retarder. Kojima et al. are not in the field of telecommunications and make no mention of retarders, or optical waveplates, given the standard acceptable definition of a waveplate. A plate as understood by a reader of Kojima is not an optical waveplate.

The cited Ando et al. patent discloses what the applicant believes is an inferior material for use with optical waveguide as a waveplate or linear retarder. Ando relies on a costly complex, time-consuming spin-coating process, wherein the applicant's invention is practiced effectively, inexpensively and in a timely manner by stretching a film of PEN producing highly uniform results at less cost, with less complexity. Kojima does not disclose the benefits of PEN over other materials he suggests for use as a transparent supporting sheet or plate, and does not disclose PEN as an optical waveplate. Contrary to applicant's invention, Kojima relies on the properties of commercially available PEN as a stable substrate which would be stretched equally to achieve the most dimensionally stable sheet. The applicant would stretch dimensionally stable PEN in a non-uniform manner to induce birefringence. Dimensionally stable PEN as taught by Kojima would not service as a retarder if one were motivated to use it in a waveguide slot of Ando.

Neither Ando et al. or Kojima et al. disclose stretching in any manner for any purpose.

Notwithstanding, in order to expedite this application and more clearly distinguish from the prior art references, the applicant has amended the claims in the following manner.

Claim 1 as amended defines:

10. An optical waveplate comprising <u>a film of</u> polyethylene naphthalate

axially stretched in at least one axial direction to form a waveplate having a thickness in a range of 2μ m to 25 μm in an amount sufficient to create birefringence such that the waveplate has a predetermined retardance for light passing through it.

Claim 1 defines a known material and a new manner of processing to achieve a new device for a use not heretofore conceived which achieves performance which applicant has demonstrated is better than any other known material used for this purpose.

In view of the foregoing, applicant respectfully requests reconsideration of this application.

Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,

Geoffrey R. Myers

Geoffrey R. Myers
Registration No: 24,897

Date: Dec. 17, 2003

Hall, Priddy, Myers & Vande Sande
10220 River Road, Suite 200
Potomac, MD 20854
U.S.A.

Tel: (301) 983-2500
Fax: (301) 983-2100

NT/ara

RECEIVED
DEC 17 2003
TECHNOLOGY CENTER 2800